



**ARCADIA
ELECTRIC UTILITY**
City of Arcadia

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January 30, 2001

Jim Loock, Chief Electric Engineer
Public Service Commission
610 N. Whitney Way
P.O. Box 7854
Madison, WI 53707-7854

RE: In the Matter of Filing Plans for Appropriate Inspection and
Maintenance, PSC Rule 113.0607.

Dear Mr. Loock:

Enclosed for filing are 3 copies of Arcadia Electric Utility's Preventative Maintenance Plan detailing inspection maintenance schedules, condition rating criteria, corrective action schedules, record keeping procedures and report filing schedules as documented in this rule.

Very truly yours,

Tim Putz
Superintendent of Electric

Enclosures

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JAN 31 2001

Electric Division

PREVENTATIVE MAINTENANCE PLAN

Arcadia Electric Utility

FILING DEADLINE

FEBRUARY 1, 2001

January 30, 2001

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Electric Division

This plan was prepared by the MEUW work group for PSC Rule 113.0607 for use by the 82 municipal electric utilities in Wisconsin and endorsed by PSC staff as meeting the requirements of Rule PSC 113.0607.

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I. Preventative Maintenance Plan

The PSC 113.0607 rule reads;

Appropriate inspection and maintenance: system reliability.

(1) PREVENTATIVE MAINTENANCE PLAN. Each utility or other person subject to this chapter, including persons who own electric generating facilities in this state who provide service to utilities with contracts of five years or more, shall develop and have in place its own preventative maintenance plan. This section is applicable to electric generating facilities as set forth at s. 194.491(5)(a)(1), Stats. Each plan shall include, among other things, appropriate inspection, maintenance and replacement cycles where applicable for overhead and underground distribution plant, transmission, generation¹, and substation facilities.

(2) CONTENTS OF THE PLAN. (a) *Performance standard.* The Preventative Maintenance Plan shall be designed to ensure high quality, safe, and reliable service, considering: cost, geography, weather, applicable codes, national electric industry practices, sound engineering judgment and experience.

1 *PSC staff interpretation is that generation applies to individual generators equal to or greater than 50 MW.*

II. Inspection Schedule and Methods:

The purpose of this plan is to maintain or improve the electrical system reliability with the objective of increased municipal loyalty and satisfaction from our constituents. The goals are to meet and exceed the schedules established in this plan.

Exception reporting (inspected equipment not in good condition) will be the method of documentation on all inspection forms.

The scope of this plan is traditional and uses proven maintenance techniques. Unique operating and maintenance philosophies have not been considered. Also, manufacturer defects will be dealt with as they are communicated to this utility.

SCHEDULE:	MONTHLY	ANNUAL	EVERY 5 YEARS
Transmission ($\geq 69\text{Kv}$ and above)		X	X
Substations	X	X	
Distribution (OH & UG)			X

The inspection of Distribution facilities will be by individual substation circuits on a 5-year cycle such that the entire system will be inspected every 5 years. Inspector instructions for inspecting all facilities and forms are included with the plan.

METHODS: Five criteria groups will be used to complete the inspection of all facilities.

1. IR – infrared thermography used to find poor electrical connections and/or oil flow problems in equipment.
2. RFI - Radio Frequency Interference, a byproduct of loose hardware and connections, is checked using an AM radio receiver.
3. SI – structural integrity of all supporting hardware including poles, crossarms, insulators, structures, bases, foundations, buildings, etc.
4. Clearance – refers to proper spacing of conductors from objects, trees and other utility cables.
5. EC – equipment condition on non-structural components such as circuit breakers, transformers, regulators, reclosers, relays, batteries, capacitors, etc.

III. Condition Rating Criteria:

This criterion, as listed below, establishes the condition of a facility and also determines the repair schedule to correct deficiencies.

- 0) Good condition
- 1) Good condition but aging
- 2) Non-critical maintenance required – normally repair within 12 months
- 3) Priority maintenance required – normally repair within 90 days
- 4) Urgent maintenance required – report immediately to the utility and repair normally within 1 week

IV. Corrective Action Schedule

The rating criteria as listed above determine the corrective action schedule.

V. Record Keeping

All inspection forms and records will be retained for a minimum of 10 years. The inspection form contains all of the required critical information i.e. inspection dates, condition rating, schedule for repair and date of repair completion.

VI. Reporting Requirements

A report and summary of this plan's progress will be submitted every two years with the first report due to the Commission by February 1, 2003. The report will consist of a letter documenting the percent of inspections achieved compared to the schedule and a description of maintenance achieved within the scheduled time allowance.

VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE

STRUCTURE

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires
- U Guard/Conduit Condition

EQUIPMENT

- Transformers
 - ✓ Oil Leaks
 - ✓ Bushing Condition
 - ✓ Grounding/Bonding
- Capacitors
 - ✓ Fuses Blown
 - ✓ Bushing Condition
 - ✓ Oil Leaks
 - ✓ Tank Bulged
 - ✓ Switches, Oil, Vacuum
 - ✓ Control Conduit/Wiring
 - ✓ Grounding/Bonding
- Switches - GOAB, Inline, Disconnect
 - ✓ Insulator Condition
 - ✓ Operating Handle/Locks
 - ✓ Linkage
 - ✓ Grounding/Bonding
 - ✓ Switch Number
- Cutouts
 - ✓ Insulator Condition
 - ✓ Fuse Size Tag

VII DISTRIBUTION – OVERHEAD INSPECTION GUIDE (con't)

EQUIPMENT (CON'T)

- Arrestor
 - ✓ Insulator Condition
 - ✓ Connections
 - ✓ Ground Lead Disconnection
- Cable Terminators
 - ✓ Insulator Condition
 - ✓ Grounding/Bonding

CLEARANCES

- Ground Line
- Buildings, Bridges, Swimming Pool, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Transmission Lines
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
 - ✓ Clearance From Line
 - ✓ Vines on Poles
 - ✓ Danger Trees

INFRARED SCAN

- Main Three-Phase Feeders
- Priority Overhead Transformer Banks
 - ✓ Bushing Connectors Primary
 - ✓ Bushing Connectors Secondary
 - ✓ General Tank Heating
- Current & Voltage Transformers if Applicable

RFI CHECK

- OH system with AM radio as each circuit is inspected

Date _____	Inspected by _____	Sub _____	Ckt _____
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VIII DISTRIBUTION – UNDERGROUND INSPECTION GUIDE

STRUCTURAL (Exterior & Interior) Transformer, Primary Pedestal, Secondary Pedestal, Switchgear.

- Enclosure Condition
- Level/Leaning
- Security
- Grade/Accessibility (Shrubs, Customer Facilities, Fill/Excavation)
- Numbering
- Voids/Gaps
- Signage - Location Number, Warning Sign
- Pad/Vault Condition

EQUIPMENT

- Transformers
 - ✓ Oil Leaks
 - ✓ Bushing Condition
 - ✓ Grounding/Bonding
 - ✓ Elbows
 - ✓ Arrestors
 - ✓ Feed-Through
 - ✓ Cable Condition
 - ✓ Secondary Connections
- Primary Pedestals
 - ✓ Elbows
 - ✓ Junction Condition
 - ✓ Grounding/Bonding
- Secondary Pedestals
 - ✓ Secondary Connections
- Switches – URD Switchgear
 - ✓ Insulator Condition
 - ✓ Operating Handle Security
 - ✓ Linkage
 - ✓ Grounding/Bonding
 - ✓ Switch Number/Fuse Size & Number

INFRARED SCAN and RFI CHECK

- Main Three-Phase Feeders (Risers & Switchgear)
- Priority URD Transformer Banks
 - ✓ Bushing Connectors Primary
 - ✓ Bushing Connectors Secondary
 - ✓ General Tank Heating

Circuit

Corrected By

IX SUBSTATION - MONTHLY INSPECTION GUIDE

TRANSFORMER MAIN TANK:

- Oil in bushings
- Bushing and arrestor porcelain
 - ✓ Cracks or chips
 - ✓ Rust or dirt
- Oil leaks
 - ✓ Main tank
 - ✓ Sample valves
 - ✓ Radiators
- Radiator bank
 - ✓ warm on top, cool at bottom
- Tank pressure
- Tank oil level
- Temperature gauge
- Cooling fans

TRANSFORMER LTC or VOLTAGE REGULATORS:

- Tank oil level
- Drag hand positions
- Cabinet light
- Operation count
- Tank pressure
- Cabinet heater
- Cabinet contamination

TRANSMISSION CIRCUIT BREAKERS:

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
 - ✓ Cracks or chips
 - ✓ Rust or dirt
- Line and load side disconnect switches
 - ✓ Properly labeled
 - ✓ Aligned properly
- Handles grounded
- Emergency trip button
- Air / Oil compressors
- Air / Oil pressure gauge
- Spring operated mechanism
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)

FEEDER CIRCUIT BREAKERS / RECLOSERS

- OPEN/CLOSED indicator
- CHARGED/DISCHARGED indicator
- Cabinet light
- Cabinet heater
- Operations counter
- Bushings and supports
 - ✓ Cracks or chips
 - ✓ Rust or dirt
- Line and load side disconnect switches
 - ✓ Labeled properly
 - ✓ Aligned properly
 - ✓ Handles grounded
- Emergency trip button
- Oil level gauge
- Tank oil leaks
- Reset switch
- Cabinet contamination
- Vents clean
- Gas pressures for GCBs

HIGH AND LOW VOLTAGE BUSS WORK:

- Bushing, insulator, arrester, and support insulators
 - ✓ Chips or cracks
 - ✓ Rust or dirt
- Bird nests
- Potential transformers bushings
 - ✓ Cracks or chips
 - ✓ Rust or dirt
- Cable terminators
 - ✓ Leaking fluid
 - ✓ Cracks or chips

MANUAL SWITCHES:

- Properly labeled
- Ground connections
- Positioning and alignment
- Bushing and support insulators
 - ✓ Cracks or chips
 - ✓ Rust or dirt

MOTOR OPERATED SWITCHES:

- OPEN/CLOSED indicator
- Properly labeled
- Cabinet heater
- Operations counter

IX SUBSTATION - MONTHLY INSPECTION GUIDE (con't)

CONTROL HOUSE/MISCELLANEOUS:

- Clock displays proper time
- AC/DC load center breakers
- Room temperature
- Rodents
- Panels labeled properly
- Panel lights
- Annunciator panel
- Panel meters
- SCADA system RTU
- SCADA alarms
- Position indicators agree
- Relay target information
- Emergency contact directory & dial tone for phone
- Safety Equipment

BATTERY:

- Liquid levels
- Proper float voltage on charger and battery
- Specific gravity in pilot cell
- Personal Protective Equipment
- Connection corrosion
- Leaking cells
- Dated solution in eyewash station

YARD AND FENCE:

- Fire extinguisher charged
- Fence ground connections
- Fence secured
- Security and emergency lights
- Site base and grade
- Standing water
- Warning signs

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

[illegible]

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

**HIGH VOLTAGE CIRCUIT BREAKER /
CIRCUIT SWITCHER**

RATING: 0 1 2 3 4 (Circle One)

	inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
OPEN/CLOSED Indicator					
CHARGED/DISCHARGED Indicator					
Cabinet Light					
Cabinet Heater					
Operations Counter					
Bushings and Supports					
Line and Load Side Disconnect Switches					
Handles Grounded					
Emergency Trip Button					
Air Compressors - Air / Oil					
Air Pressure Gauge - Air / Oil					
Spring Operated Mechanism					
Oil Level Gauge					
Tank Oil Leaks					
Reset Switch					
Cabinet Contamination					
Vents Clean					
Gas Pressures for GCBs					

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY:

DATE:

SUBSTATION:

[illegible]

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY: _____

DATE: _____

SUBSTATION: _____

HIGH & LOW VOLTAGE BUSS WORK

RATING: 0 1 2 3 4 (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Bushing, Insulator, Arrestor, and Supports				
Bird Nests				
Transformer Bushings				
Cable Terminators				

MANUAL SWITCHES

RATING: 0 1 2 3 4 (Circle One)

Properly Labeled				
Ground Connections				
Positioning and Alignment				
Bushings and Supports				

MOTOR OPERATED SWITCHES

RATING: 0 1 2 3 4 (Circle One)

OPEN/CLOSED Indicator				
Proper Labeling				
Cabinet Heater				
Operations Counter				
locking criteria				

MONTHLY SUBSTATION INSPECTION FORM

INSPECTED BY: _____

DATE: _____

SUBSTATION: _____

CONTROL HOUSE/MISCELLANEOUS

RATING: 0 1 2 3 4 (Circle One)

inspected	X	COMMENTS	DATE CORRECTED	CORRECTED BY
Clock Displays Proper Time				
AC/DC Load Center Breakers				
Room Temperature				
Rodents				
Panels Labeled Properly				
Panel Lights				
Annunciator Panel				
Panel Meters				
SCADA System RTU				
SCADA Alarms				
Position Indicators Agree				
Relay Target Information				
Emergency Contact Directory & Dialtone for Phone				
Safety Equipment				

BATTERY

RATING: 0 1 2 3 4 (Circle One)

Liquid Levels				
Proper Float Voltage on Charger & Battery				
Specific Gravity in Pilot Cell				
Personal Protective Equipment				
Connection Corrosion				
Leaking Cells				
Dated Solution in Eyewash Station				

YARD & FENCE

RATING: 0 1 2 3 4 (Circle One)

Fire Extinguisher Charged				
Fence Ground Connections				
Fence Secured				
Security and Emergency Lights				
Site Base and Grade				
Standing Water				
Warning Signs				

X Substation - Annual Inspection Guide

- Check equipment for level
- Check condition of concrete pads
- Perform oil and DGA analysis
- Battery
 - ✓ Intercell strap resistance
 - ✓ Individual cell voltages
 - ✓ Cell specific gravity
- Nameplate legible
- Equipment paint condition
- Proper equipment ID labels
- IR / RFI scans and checks

ANNUAL SUBSTATION INSPECTION FORM

Date _____ Inspected by _____ Substation _____

EQUIPMENT LISTING	SUBSTATION INSPECTION CRITERIA							COMMENTS	MAINTENANCE COMPLETED	
	Check equipment for level	Check condition of concrete pads	Perform oil and DGA analysis	Battery checks - Intercell strap resistance, Individual cell voltages, Cell specific gravity	Nameplate legible	Equipment paint condition	Proper identification labels		IR / RFI scans and checks	Date Item Corrected
Transformer										
LTC or regulators										
High Voltage Breaker										
Feeder CBs / Reclosers										
Switches										
Control house battery										
Transmission line RFI										

XI TRANSMISSION – ANNUAL INSPECTION GUIDE

STRUCTURE

- Pole Condition
- Pole Leaning
- Crossarm Condition
- Insulators, Deadend, Pin
- Excess Fill or Soil Removal
- Pole Steps
- Grounds Intact
- Ground Molding
- Down Guys
- Guy Markers
- Guy Bonding/Insulator
- Signage - Location Number, Warning Sign
- Customer Equipment
- Conductor
- Tie Wires

EQUIPMENT

- Switches - GOAB, Disconnect
 - ✓ Insulator Condition
 - ✓ Operating Handle/Locks
 - ✓ Linkage
 - ✓ Grounding/Bonding
 - ✓ Switch Number
- Arrestor
 - ✓ Insulator Condition
 - ✓ Connections

CLEARANCES

- Ground Line
- Buildings, Bridges, Etc.
- Communications Facilities
- Fuel Tanks
- Other Electric Utilities
- Over Streets, Roads, Alleys, Highways
- Tree Trimming
 - ✓ Clearance From Line
 - ✓ Vines on Poles
 - ✓ Danger Trees

XI TRANSMISSION – ANNUAL INSPECTION GUIDE (con't)

RFI CHECK

- Splices
- Connectors
- Dead Ends
- Switches
- Structures

XII TRANSMISSION – 5 YEAR INSPECTION GUIDE

IR SCAN

- Splices
- Connectors
- Dead Ends
- Switches

Date _____ Inspected by _____ Sub _____ Ckt _____

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